# DEVICE FOR GUIDING FLAT MATERIALS

## BACKGROUND

(001) The invention relates to a device for guiding flat materials.

(002) Typically, devices of the type named are used, in a digital printing machine or a copier, to guide flat materials, especially sheet-shaped materials, e.g. paper, cardboard or transparencies, between different processing stations or storage stations. The term storage stations is used to mean spaces on such a printing machine in which sheet-shaped materials are collected in stacks or withdrawn from stacks. The term guiding is used to mean that the flat materials remain on a specified transport path when they are transported through such a device for handling flat materials.

(003) The important thing in this type of device is that the flat materials are guided so securely along a transport path that no damage on the flat materials occurs and that the alignment of the flat materials is not lost during transport in order to supply different processing stations or storage stations with essentially uniformly aligned flat materials.

(004) The transport path of such a device should also be as simple to access as possible overall so that any jams of flat materials that may occur can easily be eliminated.

(005) This type of device for guiding flat materials is used in practically all digital printers and copiers and other further processing devices that process flat materials, especially sheet-shaped materials. However, these devices from the prior art have a few disadvantages. For example, it is complicated to adapt a transport path of one such device to the transport path of another device if these flat materials will be accepted directly from the upstream device in a so-called "inline" processing. This generally requires a complete remodeling of the entire transport path if the two devices were not already tuned to each other. Therefore,

if devices produced by different manufacturers are used, this problem occurs frequently, at the latest during a change in configuration.

(006) In a few of the devices from the prior art, guiding surfaces are provided that are connected rigidly on one side to the housing of the device for handling flat materials. This has a negative effect on the paper guiding, among other things because of manufacturing and assembly tolerances, which make complicated calibrations necessary.

(007) Therefore, it would be desirable to provide a device for guiding flat materials that permits secure and precise transport of flat materials between modules of a device for handling flat materials and does not have the disadvantages described above.

(008) Therefore, one object of the invention is to provide a device for guiding flat materials that permits secure and precise transport of flat materials in a device for handling flat materials and permits a simple assembly.

## BRIEF DESCRIPTION OF THE DRAWINGS

(009) Preferred embodiments of the device according to the invention will be described in more detail with reference to the drawing. The following are shown in schematic representation:

(010) Fig. 1 Shows a schematic view of the drive of one embodiment of a transport path module according to the invention;

(011) Fig. 2 Like Figure 1, additionally with side walls;

(012) Fig. 3 Like Figure 2, additionally with a lower guiding surface;

(013) Fig. 4 Like Figure 3, additionally with an upper guiding surface;

(014) Fig. 5 A schematic view of a detail of the upper guiding surface with bearing and spring;

(015) Fig. 6 Like Figure 4, additionally with detectors, mounting rods and holding elements;

(016) Fig. 7 Shows a schematic view of a transport path module;

(017) Fig. 8 Shows a schematic view of four successive transport path modules that form a device for transporting flat materials;

(018) Fig. 9 Like Figure 8, additionally with housing parts of the higher-level device for handling flat materials;

(019) Fig. 10 A schematic partial view of a higher-level device for handling flat materials.

## DETAILED DESCRIPTION

(020) Fig. 1 to Fig. 7 show, in isometric view, increasingly more parts of the transport path module 100 according to the invention. Fig. 8 shows different embodiments of transport path modules 100, 100', 100", 100"'. Fig. 9 and Fig. 10 show increasingly more parts of a higher-level device 200 for handling flat materials, especially sheet-shaped materials. Other drive, control and/or guide means and cam wheels that are generally known and necessary for operating the device are only shown schematically and/or are only described in a general way.

(021) First, Fig. 1 shows the structure of the drive 130 of the device 100 according to the invention. According to this, the drive 130 derives from a drive motor 131 that is in engagement by way of a belt 132. The drive motor 131 is e.g. a stepper motor that is fastened on the second side wall 145; see Fig. 2. The belt 132 drives a drive roller pair 135 by way of a drive roller shaft 133. In addition to the drive roller pair 135 that can be seen in Fig. 1, the belt 132 drives other drive roller pairs 135 that are not shown, which are assigned to the pressure roller pairs 135 shown in Fig. 6.

(022) The drive roller shaft 133 is mounted on both sides in the shaft bearings 138 in the side walls 141, 145, whereby the mounting in the first side wall 141 is in a slot so that a calibration option exists here in order to optimally align the drive shaft 133 (see Fig. 2). Across from the drive roller pair 135, a pressure roller pair 136 is mounted on a pressure roller shaft 137. As can be seen in Fig. 3, the drive rollers 135 extend through the lower guiding surface 150 in order to come into working connection with the pressure rollers 136. As shown in Fig. 4, the pressure rollers 136 are mounted in the upper guiding surface 160 and as shown in Fig. 5, they are pre-stressed against the drive rollers 135 by a spring 168.

(023) Upper and lower guiding surfaces 150, 160 are manufactured of extruded aluminum profile sections or steel plates that are subsequently machined in order to work in bearings and holes. For the reworking, the guiding surfaces 150, 160 are clamped in a clamping device in which they come to rest in the same position that corresponds to their later installation position. Because of this, manufacturing tolerances due to reworking can be minimized. In contrast, the side walls 141, 145 are manufactured by stamping and/or laser cutting. In this way, the positions of the holes and edges of the side walls 141, 145 can be created with very great precision, in particular with higher precision than the manufacturing of the extruded guiding surfaces 150, 160. In order to produce a device 100 that is assembled as precisely as possible, therefore, on one hand all critical tolerances are displaced to the side walls 141, 145. In addition, as shown in Fig. 3, the lower guiding surface 150 is bolted together rigidly with the sidewalls 141, 145 using the screws 152. Because of this, the device 100 obtains better stability and in addition can be handled more simply and safely.

(024) In order to be able to screw the lower guiding surface 150 to the side walls 141, 145 as precisely as possible, positioning holes 143, 146 are provided in the side walls 141, 145. During the assembly of the device 100, pins are installed in these positioning holes 143, 146, against which the lower guiding surface 150 presses before it is fastened with the screws 152.

(025) As Fig. 4 shows, the upper guiding surface 160 is fastened to the side walls

141, 145 by means of a swivel bearing so that it is movable. A stop 162 provides for the fact that the upper guiding surface 160 remains in closed state near the transport path during normal operation.

(026) Fig. 6 also shows other pressure roller pairs 136, to which drive roller pairs 135 that are not shown are assigned. As a deviation from this, in an alternative embodiment this could also involve transport belts. The distance between two pressure roller pairs 136, and thus the distance between two drive roller pairs, is selected as small as possible so that the distance is smaller than the smallest sheet-shaped material that will be processed with the device 100.

(027) Fig. 6 also shows the mounting rods 171, 172. The mounting rods 171, 172 extend through both side walls 141, 145. On both ends, the mounting rods have fastening screws 173, 174. Also, in the outer area, the mounting rods 171, 172 have a connecting point 175, 176, 177 that is connected to holding positions 275, 276, 277 of the higher-level device 200 for handling sheet-shaped materials when device 100 is in installed state and represents the only mechanical connection between the transport path module 100 and the higher-level device 200.

(028) Fig. 7 shows a complete transport path module. As can be seen in Fig. 7, the transport path is formed above and below each of two guiding surfaces, 150, 160. The second lower guiding surface 150 that was not yet shown in the previous figures is also screwed rigidly to the side walls 141, 145. The second upper guiding surface is also fastened to the side walls 141, 145 in the swivel bearing 163 so that it can swivel and has pressure roller pairs 136 to which the corresponding drive roller pairs 135 are assigned, whereby in turn these drive roller pairs 135 on a drive roller shaft 133 that is mounted in the side walls 141, 145 are connected with the drive 131. The distance between two pressure roller pairs 136 and thus the distance between two drive roller pairs is also selected here so that it is as small as possible, so that the distance is smaller than the smallest sheet-shaped material that will be processed with the device 100.

(029) Fig. 7 shows detectors 180, 182 and corresponding electronics 180', 182'

that transfer the signals of the detectors 180, 182 to a centralized or decentralized control that is not shown. The detectors 180, 182 are an edge detector 180, 182 and/or a double sheet detector 180, 182. Other detectors are also conceivable. In the input area of the detectors 180, 182 and the drive roller pairs 136, the inside width between the lower guiding surface and the upper guiding surface is narrowed so that a sheet-shaped material guided through the device 100 will be guided precisely in this area.

(030) Fig. 8 shows a transport device 300 for flat materials that is formed of several transport path modules 100, 100', 100", 100"'. This transport device 300 for flat materials represents, for example, the entire transport path of the device 200 for handling flat materials shown in Fig. 10. The transport path modules 100, 100', 100", 100"' basically all have the same structure, i.e. consist of stamped and/or laser cut side walls 141, 145, between which extruded profile sections are installed as the upper and lower guiding surfaces 150, 160, whereby the lower guiding surfaces 150 are rigidly connected to the side walls 141, 145, but on the other hand the upper guiding surfaces 160 are mounted so that they can be swiveled and stopped. For simplified representation, the pressure rollers 135, 136 and other parts of the drive 130 were left out for the transport path modules 100, 100', 100", 100"'. Each of the transport path modules 100, 100', 100", 100"' is equipped with its own drive 130 in an advantageous embodiment.

(031) Depending on the installation position of the transport path modules 100, 100', 100", 100"', the relative designations upper and lower lose their literal meaning. In cases of doubt, upper guiding surface in each case means the guiding surface 160 that is more easily accessible for a user and therefore is mounted so that it can swivel.

(032) The transport path modules 100, 100', 100", 100"' shown in Fig. 8 include a transport path module 100 for transferring flat materials to downstream devices, a transport path module 100' for branching transport paths, a transport path module 100" for accepting flat materials from upstream devices and a transport path module 100"' for withdrawing flat materials from supply trays. The input and the

output of a transport path module 100, 100', 100", 100"' is standardized in such a way that the transport path through the higher-level device 200 has no steps. The transport path module 100' for branching transport paths contains an active switch that is not shown but is known to the person skilled in the art with which the transport path can be changed over between the two paths, e.g. to an upper output or as a so-called "bypass".

(033) Fig. 9 shows additional elements of the higher-level device 200 in which the transport device 300 formed of transport path modules 100, 100', 100", 100"' is mounted. To do this, holding positions 275, 276, 277 are fastened on the front and rear housing walls 210, 215 shown in Fig. 7. In a special embodiment, a calibration option is provided for these holding positions 275, 276, 277. The transport path modules 100, 100', 100", 100"' are mounted on the holding positions 275, 276, 277 and then fastened to the front and the rear housing walls 210, 215 with the fastening screws 173, 173", 174, 174" through the fastening holes 211, 212. As can be seen in Fig. 9, a holding position 275, 276, 277 of the transport path module 100"' for withdrawing flat materials from supply trays is designed so that it is vertical. The transport path module 100"' for withdrawing flat materials from supply trays lies there securely because of the torque caused by its own inherent weight, before it is fastened by means of the corresponding fixing screws 173, 173", 174, 174". Fig. 10 shows further parts of the housing 230 of the higher-level device 200 for handling flat materials. In particular, holding positions for collecting containers 201, 202, 203 for flat materials are shown. The integrated transport device 300 has inputs 310, 320, 330 assigned to these collecting containers 201, 202, 203 for flat materials from one collecting container. The upper output 302 of the transport device 300 and the rear output 301 of the transport device 300 can also be seen.

(034) The device according to one aspect of the invention for guiding flat materials along a transport path within a higher-level device for handling flat materials is used in particular for devices that process sheet-shaped materials. However, the concept according to the invention of producing a transport path of individual, easily replaceable modules is not restricted to sheet-shaped materials

but can also be used for strip-shaped materials.

(035) According to various aspects of the invention, a device is provided for guiding flat materials along a transport path within a higher-level device for handling flat materials, whereby the device for guiding flat materials has at least one upper guiding surface that is arranged above the transport path and at least one lower guiding surface that is arranged below the transport path and two side walls between which the at least one upper and at least one lower guiding surface are fastened, whereby mounting elements are provided on the side walls, whereby the device can be used in the higher-level device for handling flat materials by means of these mounting elements.

(036) The upper or lower guiding plate is only intended to indicate a relationship relative to a transport path that runs in a horizontal direction. Depending on the installation position of the device according to the invention in the higher-level device for handling flat materials, the upper and/or lower guiding surfaces can also have different alignments. If there is any doubt, the upper guiding surface is used to mean the guiding surface that is more easily accessible and therefore is mounted so that it can swivel.

(037) Advantageously, the mounting elements represent the only mechanical connecting points between the device according to the invention and the higher-level device for handling flat materials. Because of this measure, a simple installation and removal of the device according to the invention is ensured, which can also be designated as the transport path module. In a change of configuration of the higher-level device, e.g. if a device is connected that has a deviating transport path input height, all that is then necessary in this area is to remove the device according to the invention that was previously installed in the higher-level device and to install another suitable device according to the invention into the higher-level device by means of the same mounting elements, whereby the newly installed device according to the invention just compensates the difference in height of the transport path to the downstream device. Because of this, a complicated remodeling is not necessary during a change in configuration.

(038) During combining of the transport path of the higher-level device for handling flat materials, the assembly effort is also considerably decreased. The higher-level device for handling flat materials advantageously has standardized holding positions that permit an exact alignment of the device according to the invention.The higher-level device is e.g. a paper feeding or collecting device, a further processing device, a digital printer or a copier.

(039) Advantageously, extruded aluminum profile sections or steel plates are used for the guiding surfaces. In comparison to other manufacturing methods, an extrusion has relatively high tolerances, so e.g. the manufacturing precision of stamped or laser cut sheet metal is considerably higher. In order to achieve manufacturing precision that is as high as possible for the installed device according to the invention and to ensure that the process of guiding flat materials through the higher-level device is as free of friction as possible because of this, advantageously critical tolerances are therefore defined only by the side walls that are produced by the easily manageable processes like laser cutting or stamping. In contrast, the tolerances of the extruded guiding surfaces are evened out in such a way that they have only little effect on the paper transport.

(040) In an advantageous design of the device according to the invention, the at least one lower guiding surface is connected rigidly with the two side surfaces. In this process, advantageously the connection is such that the device thereby obtains good stiffness so that handling of the device, e.g. during assembly, is considerably easier. Advantageously, the stiffness here is high enough that a bending or twisting is prevented with normal handling. This has a positive effect on the positioning accuracy during assembly and on the precision during guiding of flat materials.

(041) In order to make assembly of the guiding surfaces on the side walls easier and to achieve the desired precision in the process, advantageously either guide pins or guide fittings can be provided in the side walls, on which the guiding

surfaces contact before they are rigidly fastened to the side walls, e.g. using screws.

(042) In another advantageous design of the device according to the invention, the mounting elements are two mounting rods that extend through the two side walls, whereby the two mounting rods are fastened in the side walls, whereby the first and the second mounting rods are arranged with respect to each other so that their axes are parallel and whereby the ends of the first and the second mounting rods represent mechanical connecting elements by means of which the device can be installed into the higher-level device for handling flat materials. In this process, the mounting rods are advantageously only mounted in the side walls but not rigidly connected with them.

(043) One advantage of the design of the mounting elements as protruding mounting rods is the straightness of such rods that is ensured by the manufacturing process of this type of rods and that has an advantageous effect on precision when the device according to the invention is mounted into the higher-level device for handling flat materials. Also, the stability of the device according to the invention is relatively high because of the design of the mounting elements as mounting rods that extend through the side walls within the device for handling flat materials to which the device according to the invention is only connected by means of the mounting rods, especially in comparison to mounting elements that are only arranged on one of the side walls and do not extend through both side walls.

(044) In another advantageous design of the device according to the invention, the upper guiding surface of the transport path is mounted in the side walls so that it can swivel. Because of this, in a simple way the transport path is easily accessible at most points, e.g. in order to quickly eliminate a paper jam. Depending on the installation position of the device according to the invention, the swiveling can be a case of swiveling in different directions. Advantageously, the upper guiding surface can be stopped in the swiveled position and/or the non-swiveled position.

(045) In another advantageous design of the device according to the invention, the device has a drive for the flat materials, whereby the drive has at least one pair of drive rollers that comes into working connection with the flat materials, whereby at least one drive roller pair is mounted in the side walls by way of a drive shaft. Because of the mounting of the drive shaft in the side wall, in turn, a high precision can be achieved with respect to the installation position of the drive rollers if the side walls are created using manufacturing processes like stamping or laser cutting. This is especially true if more than only one drive roller pair is provided in the device according to the invention, which are then arranged with parallel axes in order to prevent damage to the transported flat materials or incorrect alignment of them.

(046) In another advantageous design of the device according to the invention of this embodiment, in the at least one upper guiding surface, at least one pressure roller pair that is assigned to the drive roller pair is spring mounted. This pressure roller pair is moved in conjunction with the drive rollers due to the spring loading pressing the pairs together, but can be swiveled away together with the upper guiding surface e.g. to eliminate a paper jam. To hold the pressure roller pair, the bearing in the upper guiding surface is reworked, especially if the guiding surfaces are extruded profile sections. In an appropriate reworking, advantageously a clamping device that is suitable for this will be used that clamps the guiding surface to be machined in exactly the position in which the guiding surface will later be installed in the device according to the invention. Because of this, manufacturing tolerances during reworking can advantageously be decreased.

(047) In another advantageous design of the device according to the invention of this embodiment, the device has two parallel drive roller pairs arranged one after the other in a transport direction, whereby the distance between the drive roller pairs along the transport path is smaller than the smallest flat material that will be guided with the device. In this way, even the smallest flat material always has contact with at least one drive roller pair and can be guided with precise register

through the device according to the invention. Smallest flat material is understood to mean the material that has the smallest dimensions in transport direction depending on its orientation in portrait format or landscape format, but can still be processed with the device according to the invention. Thus, this applies especially to sheet-shaped materials in contrast to strip-shaped flat materials.

(048) In another advantageous design of the device according to the invention of this embodiment, the drive has a drive motor, whereby the drive motor is mounted on one of the side walls. Thus, the device has its own drive that can be operated independently from other drives, but also by means of which a so-called synchro system can be coupled with the other drives of the transport path using a centralized or decentralized control. If several drive roller pairs are provided in the device according to the invention, the drive of all the drive roller pairs can advantageously be derived from the one motor, say using a gear or belt. On the other hand, the provision of an individual drive for each individual drive roller pair is also conceivable. Splitting the drive for the entire transport path into several individual drives has several advantages. This means, for example, if there is a paper jam, pages that are located behind the paper jam in the transport direction can be removed using the control for the corresponding motors. Provision of individual drives always has a positive effect on a change in configuration of a modular structured device, as is also possible with this invention.

(049) In another advantageous design of the device according to the invention of this embodiment, the guiding surfaces are narrowed with respect to each other in one transport direction of the flat materials before the at least one drive roller pair so that a flat material is guided in a goal-oriented way to the contact point of the drive roller pair.

(050) In another advantageous design of the device according to the invention, the device comprises detectors that monitor the flat materials. Advantageously, the distances of the guiding surfaces with respect to each other are narrowed in the area of the detectors. The detectors are, in particular, on one hand front edge

detectors that give information on the position of the flat materials on their way through the device according to the invention, and on the other, double page sensors that record the presence of double pages. Advantageously, the detectors are connected to a centralized or decentralized control that evaluates the measurements. Side edge detectors or other detectors are also conceivable.

(051) In another aspect of the inventive concept, the invention relates to a device for handling flat materials with a housing of at least two parallel side walls and a transport path for the flat materials between these side walls, whereby the side walls have a number of holding positions that are suitable for holding at least one transport path module. Because of this, a modular transport path can be produced more easily, which is easy to subject to a configuration change, say in order to adapt the input or output height of the transport path to other, different devices for handling flat materials like further processing devices, printers, collecting stations, etc. Especially advantageously, the transport path module is a device according to the preceding description. Advantageously, the mounting points are each four elements per transport path module, of which, in pairs, two are designed as V or U-shaped elements for a two-point mounting and two as straight elements for an additional single-point mounting so that in each case a three-point mounting of each transport path module results in both side walls.

(052) In an advantageous design of the device according to the invention, the holding positions can be calibrated in such a way that an alignment of the transport path modules is possible. In this way, manufacturing tolerances can be further compensated. Advantageously, a calibration of this type is only necessary once since, with a replacement of a transport path module, no position changes of the mounting elements with respect to the preceding transport path module should occur.

(053) In one advantageous design of the device according to the invention, the at least one transport path module is one of the following: transport path module for transferring flat materials to downstream devices; transport path module for

branching transport paths; transport path module for accepting flat materials from upstream devices; transport path module for withdrawing flat materials from supply trays.

(054) Especially advantageously, the entire transport path of the device will be formed of this type of transport path modules. Because of this, the device for handling flat materials is very flexible and maintenance friendly and at the same time, a very precise transport path can be achieved. Advantageously, the transport path consists of at least one transport path module for accepting flat materials from upstream devices and one transport path module for transferring flat materials to subsequent devices.

(055) According to another aspect of the inventive concept, the invention relates to a method for guiding flat materials through a device for handling flat materials with the following steps: providing a device for handling flat materials according to the description above; installing at least one transport path module into the device to create a complete transport path; and start-up of the device for handling flat materials. In the last step, the drives of the transport path modules are installed and the control of the drives is handled by centralized or decentralized electronics. The drives of the transport path modules can be a common drive, to which the drives of the at least one transport path module are coupled; on the other hand, it can also be a transport path module with a single drive, with a control that has to be coordinated with the control of the higher-level device and if necessary upstream or downstream devices for handling flat materials.

(056) In an advantageous further development of the method according to the invention, the method additionally comprises the following step: calibration of the transport path modules. In this process, a calibration to the other transport path or the other transport path modules takes place. Advantageously, this calibration only has to be carried out once and does not have to be repeated if there is a change in transport path modules.

(057) In another advantageous further development of the method according to the invention, the method additionally comprises the following step: adapting the transport path to the transport path of an upstream and/or downstream device by changing at least one transport path module.

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